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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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10/680,895

10/08/2003

Helen Zhu

P1052-LAM (RAO#1)

5978

7590

03/18/2005

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EXAMINER

NGUYEN, THANH T

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 03/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                                      |                                   |  |
|------------------------------|--------------------------------------|-----------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/680,895 | <b>Applicant(s)</b><br>ZHU ET AL. |  |
|                              | <b>Examiner</b><br>Thanh T. Nguyen   | <b>Art Unit</b><br>2813           |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12/9/04.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10/8/03</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's arguments with respect to claim 1-26 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (U.S. Patent No. 5,970,376) in view of Pangrle et al. (U.S. Patent No. 6,566,283) and Wu et al. (U.S. Patent No. 6,720,256) and Hsue et al. (U.S. Patent No. 6,696,222).

Referring to figures 8-11, Chen teaches a method of forming a damascene structure comprising:

forming an silsesquioxane layer (66, called OSG, see figure 8, col. 17-33),

forming a cap layer or hardmask (68) on the OSG layer,

forming a photoresist layer (70, see col. 14, lines 46-55), etching the cap layer and the OSG layer to form a via (68a, see figure 9).

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Generating a high selectivity between the photoresist and the OSG. It is inherent that since removing the photoresist layer without removing the organic material (OSG) it would generating the high selectivity.

Regarding to claim 2, 7, 18, the photoresist is an organic photoresist. Noted that it is known in the art that photoresist is made of organic material.

Regarding to claims 4, 8, the stripping of the photoresist is performed in the same reactor used for etching the OSG material (see col. 17, lines 3-9).

Regarding to claim 6, since remove the photoresist without remove the hardmask and the OSG film, therefore it would generating a high selectivity.

Regarding to claim 10, the intermediate layer is a cap layer (68, see figure 8).

Regarding to claim 11, cap layer is selected from a group consisting of silicon dioxide (see col. 14, lines 10-15, 37-45).

Regarding to claim 12, the second intermediate layer is a hard mask layer (called capping layer, 68, col. 14, lines 36-45).

However, the reference does not teach silsesquioxane-SOG is an OSG layer, forming a dual damascene, etching the trench into the second hardmask layer and apply another the photoresist layer to form a via etch by etching into the OSG layer, providing a via etched into the IC structure, generating an organic plug that occupies the via; and stripping organic plug, the hardmask layer selected from the group consisting of silicon nitride.

Pangrle et al. teaches a low k dielectric layer (12) silsesquioxane SOG such as OSG film (see col. 5, lines 15-26).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to form a low k dielectric layer such as OSG film in process of Chen as taught by Pangrle et al. because silsesquioxane SOG is known in the art to include the OSG film with a low dielectric constant.

Wu et al. teaches forming a dual damascene (see figure 6d), forming the hardmask layer selected from the group consisting of silicon nitride (see col. 9, lines 62-67), providing a via etched into the IC structure (see figure 6a), Generating an organic plug (80, called resin) that occupies the via; and Stripping organic plug (see figure 6d-6e).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a dual damascene, providing a via etched into the IC structure, generating an organic plug that occupies the via, and stripping organic plug, the hardmask layer selected from the group consisting of silicon nitride in process of Chen as taught by Wu et al. because the process would provide a wider process latitude and higher yield during the formation of dual damascene structures are provided. The method is resistant to poisoning from adjacent layers and does not form scum or residue in via holes during

trench patterning, and is compatible with high throughput, low cost manufacturing process.

Hsue et al. teaches a method of forming a dual damascene process using metal hardmask layer comprising the step of: etching the trench into the second hardmask layer (see figure 2b-2c) and apply another the photoresist layer (44) to form a via etch (45) by etching into the OSG layer (36, see figure 2d-2f).

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Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would etching the trench into the second hardmask layer and apply another the photoresist layer to form a via etch by etching into the OSG layer in process of Chen as taught by Hsue et al. because the process would reduce RC delay and cross talk, lower production cost and simplify the dual damascene process

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).



Thanh Nguyen  
Patent Examiner  
Patent Examining Group 2800

TTN